Comment on the paper "Weyssenhoff fluid dynamics in a 1+3 covariant approach" (arXiv:0706.2367)

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Few comments are given to clarify some issues of Weyssenhoff fluid in the Einstein-Cartan gravity.

The authors of the paper "Weyssenhoff fluid dynamics ..." [1] Brechet, Hobson and Lasenby compare their treatment and results with my paper "On primordial cosmological density ..." [2]. I list some clarifications and comments:

(1) The relation (4) from [2] is just the generalized Ricci identity derived by Hehl (see Eq. (3.41) of [3]). "Effective field equations" are valid generally in Riemann-Cartan spacetimes, and not only for the Weyssenhoff fluid. This is also proved by Hehl (see Eq. (3.78) of [3]). It is just the consequence of the algebraic relation between spin and torsion (namely, the absence of spacetime derivatives).

(2) Conformal Weyl tensor does not appear in field equations, but only in Ricci and Bianchi identities describing tidal forces in clumpy Universe. However, the Universe is clumpy at small scales from dark ages to the present. The N-body cosmic simulations with Newtonian gravity imbedded into some background geometry (homogeneous or inhomogeneous, isotropic or anisotropic) are the most suitable theoretical tools in such a situation, certainly not the Weyssenhoff fluid in general relativity. This is the reason why I do not include Weyl tensor at large scale and large redshift considerations.

(3) The evolution equations are derived in [2] by combining Ricci identities and field equations. The conservation equations are similarly obtained from Bianchi identites and field equations by Obukhov and Korotki [4]. It suffices then for the main topic of my paper to study the evolution of the mass-density contrast at large scales and large redshifts within the gauge invariant formalism of Ellis and Bruni [5].

References

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[2] D. Palle, *Nuovo Cim.* **B 114** (1999) 853.

[3] F. W. Hehl, *Gen. Rel. Grav.* **5** (1974) 491.

[4] Yu. N. Obukhov and V. A. Korotky, *Class. Quantum Grav.* **4** (1987) 1633.

[5] G. F. R. Ellis and M. Bruni, *Phys. Rev.* **D 40** (1989) 1804.